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ABSTRACT

This document examines issues and techniques related to assessment of online learning for adult, career, and vocational education. The document begins with an overview of the disadvantages of assessing at a distance and the issue of security in the online environment. The following aspects of continuous assessment are discussed: characteristics (careful, systematic, and planned); issues (pacing, feedback, and learning quality); and types of continuous assessment activities (ungraded activities and feedback built into study materials; self-assessment quizzes and tests; formal feedback on assignments from instructors, peers, or workplace colleagues or mentors; informal dialogues with instructors, peers, and others; and ungraded tests that prepare learners for graded assessment). Presented next are guidelines for making online assessment interactive by taking actions such as the following: comparing learner answers with correct answers and giving feedback; recommending remediation; and showing Web pages with more information on missed questions. The following activities of effective instructors in online assessment environments are considered: acting as a coach, mentor, and facilitator; communicating information; providing timely feedback; and being a team member. The advantages, disadvantages, and examples of the following forms of assessment are detailed: case studies; discussions; microworlds/simulations; electronic portfolios; and self-assessments. The bibliography contains 45 references. (MN)

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Assessing Learners Online
Practitioner File

Sandra Kerka and Michael E. Wonacott

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Assessing Learners Online

Practitioner File

More and more teaching and learning are taking place at a distance, especially on the World Wide Web. How do educators measure what distance learners know? This issue of the Practitioner File looks at issues and techniques related to the assessment of online learning for adult, career, and vocational education. We address assessment in the sense of obtaining and interpreting information about what has been learned, rather than evaluating web-based courses and instruction (although we found that the literature tilts more toward course evaluation than learner assessment). Inside you will find discussions of the principles, advantages, and challenges of online assessment; the concepts of continuous assessment and interactivity; the role of the instructor; and descriptions of types, tools, techniques, and resources.

Online Assessment: Principles and Practices

Learner assessment has a foundation of good practice whether it takes place online or face to face (Dirks 1997; Zvacek 1999). Assessment is usually intended to provide both instructors and learners with information on progress and to measure achievement of learning goals. Formative assessments provide ongoing feedback to improve instruction and learning. Summative assessments are made to assign value to what has been learned (Australian National Training Authority 1999; Hopper 1998). Principles of good assessment include validity (does it measure what is intended?), reliability (does it consistently produce the same information?), flexibility (are various methods and approaches used to accommodate diverse needs?), and fairness (is it free of biases?) (ANTA 1999; Juchnowski and Atkins 1999). The quality of test construction matters: "Bad questions...lead to poor test results. Whether presented to students on paper, electronically, or verbally, good questions are an essential feature of a test" (Sephton 1999, n.p.). Because assessment has multiple purposes, multiple methods are needed.

These principles apply to assessment regardless of the delivery mechanism. There are, of course, differences between online and face-to-face situations. Some of the disadvantages and advantages to conducting assessment at a distance are discussed here, concluding with some principles and practices for online assessment.

Disadvantages of Assessing at a Distance

"Assessment and measurement become even more critical in the absence of the face-to-face interactions that enable teachers to use informal observation to gauge student response, obtain feedback, and progress toward goals" (Pennsylvania State University 1998, n.p.). This lack of nonverbal cues poses the greatest challenge to online assessment. Other disadvantages include the following ("Assessing Students" 1999; Juchnowski and Atkins 1999)—

- Learner isolation and the impersonality of computerized assessment
- Lack of instructor control over assessment conditions
- Uneven access of learners to technology and resources
- Technical problems associated with access—e.g., media-rich learning activities such as video segments may be expensive to produce and slow to download; failed hardware or phoneline outages may prevent access
- Learners' and instructors' technical skill levels
- Learner anxiety about being disadvantaged by difficulties with the technology
- Instructor time to score tests and provide feedback
- Fatigue—lengthy assessment activities may stress the eyes from the use of computer screens

Two issues that may create particular barriers to online assessment are security and the need for programming.

Security

Ensuring that the individuals completing the assessment are who they say are (authentication) "is an issue in all examinations...However, in a computer environment, impersonation may be perceived as a greater risk" (Mogey

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Online Assessment: Continuous and Interactive

Communication works somewhat differently in web-based training and distance education than in the traditional classroom. In the traditional classroom, face-to-face communication allows all parties to send and receive a full range of verbal messages, both written and oral, as well as nonverbal messages like facial expression, tone of voice, and inflection that give additional information. In particular, traditional classroom instructors can monitor nonverbal communication as a check on learners' comprehension; a puzzled look or a pause in notetaking can indicate that learners are not comprehending (Champagne 1998).

Online communication using computer-mediated communication (CMC) mechanisms such as e-mail and computer conferencing is different in two important respects, however (Bigelow 1999). First, online communication is not as rich; it's usually only written text with static graphic images (if any). Since instructors cannot observe learners, there are no nonverbal messages indicating comprehension or lack thereof. Second, online communication is typically slower because you can't type as fast as you can talk. The extra time allowed by that slower rate of communication can lead to more thoughtful interactions, but it can also have an adverse effect on the interpersonal interaction.

Continuous Assessment

Those important differences in communication mean that in distance education, assessment for formative purposes becomes much more important. Since online instructors and learners cannot communicate as quickly, easily, and fully, instructors need to take extra steps to monitor learners' performance and comprehension (Lindner 1998). *Continuous assessment* allows instructors to familiarize themselves with each learner's work repeatedly to help ensure that understanding occurs (Schrum 1998). In other words, since online instructors can't see their learners, can't observe nonverbal clues, and can't ask quick, impromptu questions to check comprehension, instructors must use other means to ensure that learners are on the right track (Thorpe 1998).

Careful, Systematic, and Planned

The results of continuous assessment can certainly be graded and included in determining a final course grade, but the purpose is more formative than summative. So to be effective, continuous assessment must be more than just a final add-on to instruction for determining a grade; it must be planned carefully and systematically as an ongoing part of instruction. Planning for continuous assessment should take three key issues into account (ibid.):

- **Pacing**. Continuous assessment should require that learners demonstrate and use what they have learned by completing an independent piece of work (alone or in groups) at a specified point in instruction. The mechanistic constraint of pacing helps learners manage and schedule their own learning, while it also enables constructivist learning by providing scaffolding that helps learners use what they have already learned to construct a coherent understanding of new information.

- **Feedback**. Instructors provide feedback on the quality of learners' understanding. Again, feedback provides expert scaffolding to help learners construct understanding; timely, critical feedback helps learners improve and refine their early understanding. In addition, positive feedback provides experiences of success that motivate learners to continue, overcoming obstacles if necessary.

- **Learning quality**. Both pacing and feedback directly affect whether learners study and learn and how effectively they do so. The assigned activities determine what learners learn by directing them to specific content areas and by requiring specific skills (e.g., problem solving, calculation, analysis, synthesis, communication).

Kinds of Activities

A range of activities can be used for continuous assessment to help develop learning, as long as assessment activities are closely aligned and interwoven with study materials (Morgan and O'Reilly 1999):

- Ungraded activities and feedback built into study materials
- Self-assessment quizzes and tests that allow learners to check their own learning
- Formal feedback on assignments from instructors, peers, or workplace colleagues or mentors
- Informal dialogue with instructors, peers, or others
- Ungraded tests that prepare learners for formal, graded assessment

Assignments and informal dialogue offer many opportunities for continuous assessment in particular. For example, learners can be required to participate in online CMC conferences; they might be required to submit a minimum number of messages contributing to the discussion and re-

ceive instructor feedback on the quality of those messages; or they might receive feedback on the quality of specific contributions they submit for feedback (Thorpe 1998). Assigned activities and dialogue can also involve group activities or projects in which learners collaborate to solve a problem, create a simulation, design a product, or complete a task (Schrum 1998). Of course, one critical criterion in identifying assessment activities is that they must relate to the learning objectives you have established (Jarmon 1999).

Providing Feedback

The feedback instructors give in continuous assessment should provide the scaffolding that allows learners' understanding to grow and evolve. It should be full and specific enough to tell learners clearly when and how they are on track or off track–for example, "Good job identifying the primary differences... [between two theories]. Your response is right on target. Should this be an exam question, you might want to elaborate a bit on each difference (e.g., give an example of each of these differences related to a teaching strategy)" (Hazari and Schnorr 1999, p. 36). Inexperienced online learners may be particularly reassured by instructor feedback that confirms they're on track and doing well (Thorpe 1998).

Feedback should be timely and prompt; full, specific feedback is most useful when learners receive it in time to use it effectively. Furthermore, learners are most likely to use feedback productively when they are oriented beforehand to its purpose and significance, and when feedback is provided in a consistent format (e.g., separate comments on structure and format of learner work; sequence of comments from the general to the specific) (Mann 1998). Finally, feedback—particularly on graded assessments—should always be based on consistent, clearly communicated standards, or rubrics (Nelson 1998).

Interactive Assessment

Online assessment in distance education can make use of Internet technologies that allow greatly increased communication, interactivity, and collaboration compared to the traditional classroom or paper-and-pencil forms of distance education. CMC allows synchronous and asynchronous, one-to-one, one-to-many, and many-to-many communication; its use of text-based communication promotes thoughtful and reflective commentary (Schrum 1998). The interactivity possible in online continuous assessment, either with the online environment or with instructors or other learners, helps engage learners in active application of knowledge, principles, and values and provides them with feedback that allows their understanding to develop (Hazari and Schnorr 1999). Hence, online assessment can play an important part in a constructivist learning experience.

In addition, online assessment can take advantage of the capabilities of other software applications to develop interactive online tests with a wide array of functions (Dickinson 1997):

- Record answers to a file the instructor can review later.
- Compare learner answers with correct answers and give feedback.
- Grade the test and give feedback.
- Recommend remediation.
- Show the learner a web page with more information on a missed question.
- Prevent the learner from proceeding to new instruction until the learner passes the test.
- Control retries—allow any number or a restricted number only.
- Require the learner to enter a name and controlled password.
- Restrict the dates on which learners can take the test, avoiding last-minute test-taking.
- Time the test.
- E-mail test results to the instructor.

Developers can create customized online tests from scratch using programming languages such as Common Gateway Interface (CGI) (ibid.), Active Server Pages (ASP), and JavaScript (Doulai and Stace 1998; Gray 1999) or commercially available packages such as Toolbook II, Macromedia Authorware, Jamba, or CGI*Star (Dickinson 1997). Easiest to use are commercially available template-based instructional management systems, for example, WebCT, Blackboard, TopClass, and Web-Course-in-a-Box (Bigelow 1999). Interactive tests can include multiple choice, true/false, matching, and even essay questions (ibid.), although scoring essay questions is difficult for anything beyond merely looking for specific words or sequences of words in learner answers (Dickinson 1997).

The Role of the Instructor

A key factor that distinguishes distance education from the traditional classroom is the dramatic shift in the role of the instructor from being the authoritative source of knowledge to being a facilitator of learner-centered, collaborative, and egalitarian learning (Hutton 1999). Instead, instructors can take advantage of the potentially constructivist online environment to build in opportunities for creativity, so that learners can relate learning to their experience and local context. The governing principle is that learning is an active process in which learners construct rather than acquire knowledge, and the instructor's role is to support that construction rather than communicate knowledge (Milman 1999).

Being a Mentor, Coach, and Facilitator

That constructivist perspective also applies to the instructor's role in online assessment. First, instructors may find that they do *less* questioning, probing, and focusing in continuous assessment. In the online environment, the capabilities of CMC allow learners to take a more active and facilitative role. The instructor assumes a more social role: forming a supportive learning environment, promoting human relationships, maintaining the group as a unit, and helping members work together in a mutual cause (Hutton 1999). In addition, distance education students are often typical adult learners—self-directed, motivated by personal learning goals, willing and able to apply their own experience to learning content (Tillson et al. 1998). As a result, the instructor's role as mentor, coach, and facilitator helps encourage connections and learning made possible by carefully, systematically planned continuous assessment (Elliott 1999).

Furthermore, instructors are often the first point of contact for distance education learners when they need administrative, technological, or affective support (ibid.). Instructors must be able to provide referrals and linkages to technology services, support services, and other institutional resources. Inexperienced learners often rely on assistance from instructors to acquire the technology skills needed to conduct a web search or participate in a chatroom discussion (ibid.). And prompt intervention with affective support and even tips on stress management is well appreciated by distance learners who are uncertain how to proceed.

Communicating Information

In the traditional classroom, instructors are used to providing direction, guidance, and feedback orally as a part of assessment. In online assessment, however, instructors must provide that same direction, guidance, and feedback in writing; thus, instructors must communicate clearly and effectively in a different medium (ibid.). Instructors are likely to find that writing takes more time than talking, and they may also find that, like learners (Hutton 1999), they *want* to take more time and be more thoughtful when communicating in writing.

One key factor in communicating effectively in writing is the content of feedback provided to distance learners. The content of feedback needed can range from a simple "Yes, that's correct" to a much more complex presentation in a whole new way to aid understanding (Gibson et al. 1995) Similarly, distance learners have a particular need to know clearly and specifically what the expectations are and what constitutes successful outcomes; they should know this before they begin the course. Working on the Web may require more detailed descriptions and definitions of success (Hardy 1999). Weight assigned to different factors in graded assessments (e.g., 30 percent for presentation and organization, 70 percent for content and relevance) is especially important (Mann 1998). Learners typically make more positive comments on instructor feedback on actual assignments when that feedback is fuller and more detailed (Thorpe 1998).

Instructors should also remember that online communication involves more than feedback on the details of learning content (ibid.). Online learners also value advice and guidance to help them start and stay on track. Inexperienced learners may especially appreciate confirmation that they are on track—they may be glad to have that specific reassurance even though their instructor has said that he or she would step in if they got off track.

Providing Timely Feedback

The timeliness of feedback instructors provide is crucial. There is little point in making extensive comments on learner work if the learner doesn't receive them *before* going on to the next assignment; the learner needs to be able to incorporate the feedback into the next assignment (Dirks 1998). Learners usually react favorably to frequent contact and feedback from instructors (Tillson et al. 1998), especially in the initial planning stages of project work.

Although the asynchronous nature of CMC is usually one of its most appealing features, learners may benefit from online office hours at specified times so learners can log on and talk with the instructor in a chatroom (Zirkle and Ourand 1999). Instructors can monitor the effectiveness of their online communication by asking learners about their perceptions and assessment of the quality of that feedback (level, structure, content, relevance, usefulness) in order to improve effectiveness (Mann 1998).

Being a Team Member

Instructors must keep in mind that they may be only one member of the distance learning team, which can also include instructional designers, instructional developers, technology supporters, facilities supporters, materials supporters, distant-site facilitators, and management sponsors (Abernathy 1998). As team members, instructors often find that far more time and attention to detail are required than for face-to-face courses. Teamwork and cooperation among instructors, technical media specialists, and administrators are critical. Instructors may need to complete course plans and materials well in advance so that other team members can do their part (Tillson et al. 1998).

Equally, instructors often receive significant support and assistance from other team members, particularly technology staff (McDougall, Place, and Currie 1999). For example, technology support staff may provide online management systems designed to enable instructors with little or no computer experience to create online tests with multiple choice, short answer, and essay questions incorporating formatted text, images, video, and audio both for learner self-assessment and graded assessment. Systems might randomly create tests from item data banks, grade the results, and post them both to learners and instructors.

Such sophisticated online systems often make their own demands on instructors. If an online system creates randomized tests using an item bank, instructors may need to write additional test items from which to draw. Likewise, if the online system provides content-related hints for learners during the test, instructors need to provide that content information to technology staff. Finally, instructors may need to supply detailed content information in the forms of hints (received by learners during the test, based on their answers to guide them in the correct direction) and key words or other forms of expert answers (Kennedy and Eizenberg 1998).

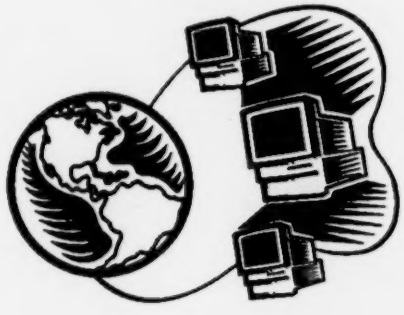
Institutional technology support might offer professional development opportunities like training sessions in specific technologies, long- or short-term programs that provide the time and resources for instructors to acquire technology skills, targeted workshops and demonstrations, and one-on-one consultation. Assistance may be available not only from full-time technical experts but also from part-time student staff who are familiar with software applications. Instructors can also develop skills by sharing experiences, ideas, and discoveries with one another (Zirkle and Ourand 1999).

Types of Online Assessment

A variety of methods may be used online to assess learners in the following areas (Morgan and O'Reilly 1999):

- Critical thinking (essays, reports, reflective journals)
- Problem solving (multimedia or text-based scenarios, simulations using CD-ROM, videoconferencing)
- Demonstrating techniques (videoconferencing, verification by workplace mentor, site monitor)
- Self-management (journal, autobiography, portfolio, learning contract)
- Information access/management (database development, bibliography, problem solving)
- Demonstrating knowledge (written exam with local proctors, quick feedback through multiple choice, true/false matching, short answer tests)
- Designing, creating (portfolios, projects using video or the Web)
- Communicating (debate, role play, PowerPoint presentation, report journal, essay)
- Teamwork and collaboration (e-mail, listserv, or conferencing discussions/debates)

Advantages, disadvantages, and examples of several types are presented in the chart on page 6.



	Advantages	Disadvantages	Examples
Case Studies (Dirks 1998, Niederhauser et al. 1999)	Current, authentic, require comprehensive application of learning	Subjective, time consuming for learners to complete and instructors to grade	Four interactive case studies on disease prevention and health promotion (Niederhauser et al. 1999) were included in a nurse practitioner web-based course using two types of CGIs–NetCloak and Netforms. The site included links to faculty, a syllabus, bibliography, guidelines for task completion, required readings, grading criteria, and the evaluation. The tasks included finding websites relevant to cases, answering questions about cases online, and participating in online discussions over 2 weeks. Learners were evaluated on their use of the Internet for learning as well as case discussions, answers, and websites found. The cases thus developed both content knowledge and information literacy skills.
Discussions (Nelson 1998; Tarouco, de Vit, Hack, and Geller 2000)	Require thoughtful conceptualization and presentation of ideas; encourage some who are intimidated by face-to-face discussion; instructor monitoring of discussions catches problems early	Generate huge amounts of text to be evaluated, may require new types of assessment criteria, present time and access constraints	Tarouco et al. (2000) describe a learning environment developed to support group work and learner assessment through the Internet using a set of computer-mediated distance learning tools: a consensus tool (based on Delphi technique) collects and tabulates responses and level of contributions to discussions; a tracking tool registers pages accessed, date/time; a voting tool provides fast feedback from learners to instructor; and a self-evaluation tool enables learners to chart their own progress.
Microworlds/ Simulations (Hopper 1998; Schacter et al. 1999)	Require learners to construct knowledge and use metacognitive strategies; allow performance-based assessment	Can involve complex programming and specific hardware and software	Middle school students (Schacter et al. 1999) move from novice to expert knowledge of environmental science by assembling a concept map, an authentic task involving electronic information-seeking skills (exploration, creation, relevance, extraction, synthesis, organizing, representation). Four computer tools were used: (1) Java Mapper (concept mapping software); (2) a simulated web environment (database of 200+ selected websites); (3) a bookmarking Java applet; and (4) feedback provided in real time (comparison of learners' performance to expert performance). Students could also construct knowledge maps synchronously and collaboratively using HyperCard® or Java knowledge management software.
Electronic Portfolios (Aschermann 1999; Milman 1999)	Accommodate multiple intelligences; present a cross-section of achievements and skills; capture performance data; require critical self-assessment	Can emphasize bells/whistles; require time to compile and assess; creators and assessors need technical skills; storage space and transportability may be barriers	Electronic portfolios are being used increasingly in preservice teacher education. Aschermann (1999) describes how preservice teachers originally created them on CD-ROM, but they were difficult to update and production hardware/software was costly. They switched to Netscape Composer, a free program requiring little technical knowledge. Use of the Web improved portfolio quality and allowed assessment of technology skills as well.
Self-Assessments (Bigelow 1999; Taylor 1998)	Teach a lifelong skill; important in distance learning because of potential remoteness, isolation, few opportunities for interaction and monitoring; online instruments are easily scored and analyzed, providing instant feedback; learners can retry and reevaluate	Must account for diverse backgrounds and approaches to study; self-assessment that provides only model answers or solutions is not useful	Self Test <http://www.usq.edu.au/users/taylorja/Selftest.htm> is an Australian instrument designed so that learners can write out their solutions to math problems in detail, have a means of comparing their solution with a model solution, have a number of alternative model solutions available to them if appropriate, be credited when they get only part of a solution correct, and be given a summary at the end of each session detailing which topics they still have to master.

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Austin, J. T., and Mahlman, R. A. "Using the Internet for Career-Technical Assessment: A Pilot Project in Ohio." ***Journal of Career and Technical Education*** 16, no. 2 (Spring 2000): 27-37.
Presents results of a study of administrative office technology assessment delivered via the Internet. Discusses strategies for moving career-technical assessment to the Internet.

Australian National Training Authority. "Flexible Learning Toolbox Project." 1999. http://www.anta.gov.au/toolbox/; www.toolboxcentral.com
Offers multimedia resources that provide tools for the development, implementation, and evaluation of online vocational training programs. Includes guides for developers, facilitators, project managers, and support staff.

Canale, R., and Duwart, E. "Internet-based Reflective Learning for Cooperative Education Students during Co-op Work Periods." ***Journal of Cooperative Education*** 34, no. 2 (1999): 25-34.
Explains how distance learning links cooperative education students to their institution during work experiences. Describes the use of conferencing software for assignments and reflective discussions.

Gallant, G. M. "Professional Development for Web-based Teaching: Overcoming Innocence and Resistance." ***New Directions for Adult and Continuing Education*** no. 88 (Winter 2000) forthcoming.
Addresses faculty development issues and lists numerous resources to help prepare teachers for web-based instruction.

Hayes, K., and Huckstadt, A. "Developing Interactive Continuing Education on the Web." ***Journal of Continuing Education in Nursing*** 31, no. 5 (September-October 2000): 199-203.
Explores the use of Java scriptlets to provide formative evaluation and feedback throughout virtual patient scenarios in online modules for nurse practitioner self-study.

Human, S. E.; Kilbourne, L. M.; Clark, T. D.; Shriberg, A.; and Cunningham, B. "Using Web-Enhanced Instruction in an Interpersonal Skills Course." ***Journal of Management Education*** 23, no. 5 (October 1999): 584-606. (EJ 592 565)
Describes how management students developed criteria they then used to select web-based diagnostic self-assessment tools for a course on interpersonal skills.

Journal of Management Education 23, no. 6 (December 1999). Special Issue: Innovative Uses of Information Technology in Management Education.

Bigelow, J. D. "The Web as an Organizational Behavior Learning Medium." pp. 635-650. (EJ 596 509)
Addresses the impact of moving learning activities to an online medium, including effects on team projects, role plays, self-assessment, interactive cases and simulations, exams, and feedback.

Chappell, D. S., and Schermerhorn, J. R., Jr. "Using Electronic Student Portfolios in Management Education: A Stakeholder Perspective." pp. 651-662. (EJ 596 510)
Discusses how a business school is using electronic student portfolios for academic assessment, career development, internship, and job placements. Recommends that they be mandatory, even for students with weaker computer skills, and they should have defined deadlines and feedback mechanisms.

Shrivastava, P. "Management Classes as Online Learning Communities." pp. 691-702. (EJ 596 512)
Describes the use of eSocrates software for networked communications in the creation of an online learning community in business education.

Meisel, S., and Marx, B. "Screen to Screen versus Face to Face: Experiencing the Differences in Management Education." pp. 719-731. (EJ 596 514)
Presents an online experiential exercise on power and negotiation to explore differences between online and traditional education.

Niederhauser, V. P.; Bigley, M. B.; Hale, J.; and Harper, D. "Cybercases: An Innovation in Internet Education." ***Journal of Nursing Education*** 38, no. 9 (December 1999): 415-418. (EJ 596 594)
Describes a mix of traditional and technological modes to present online case studies for nurse practitioner continuing education. Addresses security, computer literacy, and evaluation issues.

Schilke, R. A. "Web-based Instruction for Adult Educators—Hi-Touch versus Hi-Tech." In ***Proceedings of the 19th Annual Midwest Research to Practice Conference in Adult, Continuing, and Community Education***, edited by M. Glowacki-Dudka, pp. 208-212. Madison: University of Wisconsin, 2000.
Asserts that most literature and practice in web-based instruction is behaviorist. Attempts to identify course designs and techniques that are better aligned with adult learning principles and theories.

Zirkle, C., and Ourand, D. B. "Teaching a Course through Multiple Delivery Systems: Some Lessons Learned." Paper presented at the Indiana Postsecondary Education Conference, Muncie, IN, October 25, 1999. (ED 435 800)
Describes how Indiana State University offers courses for bachelor's and master's degrees in human resources development, technology education, and vocational-technical education using satellite transmission to remote sites, videotape, and the Internet.

and Watt 1999, n.p.). As King (1998) notes, "no existing technology can ensure academic honesty" (p. 27). However, some suggested security measures include the following (Dickinson 1997; Gray 1997; Jarmon 1999; King 1998; Sephton 1999; Zirkle and Ourand 1999):

- Holding proctored examinations at remote sites
- Minimizing objective tests and focusing on methods calling for analysis and application (essays, case studies, etc.)
- Constraining access to the website of a test through passwords and usernames
- Embedding quizzes into exercises and readings
- Randomizing questions and the order in which they are presented
- Carefully designing Web-based instruction to convey outcomes the learner perceives as useful and desirable
- Considering online exams in the same way as take-home tests. As Nelson (1998) points out, "they will never be asked on the job to sit away from all reference materials, forced to solve problems and communicate in isolation" (p. 2)
- Using multiple sources of assessment data

According to Gray (1997), the potential of the Web to create a virtual community can give instructors additional "reality checks": Through e-mail and web-based discussions, instructors become familiar with the writing styles and abilities of individual students, so that an exam written in a radically different style would be a red flag. "Integrating collaborative elements such as joint projects, synchronous and asynchronous discussion forums, and workgroup computing can further reduce the possibility of misrepresentation and increase student accountability" (ibid., n.p.).

Programming

Instructors' lack of programming skill as well as the time involved can be major barriers to online assessment. Some commercial software allows customization without requiring programming, but it is often platform specific or requires certain applications or players (Gray 1999). Web editing software such as HotMetal or FrontPage can be used to create HTML forms and tests. A number of resources listed on page 10 provide free examples of JavaScript and Common Gateway Interface (CGI) programs, and the articles in the bibliography by Dickinson (1997), Doulai and Stace (1998), and Gray (1999) give advice for incorporating these tools in online assessment. Hayes and Huckstadt (2000) describe the use of Java scriptlets and FrontPage to create online continuing education modules for nurse practitioner self-study. Examples are provided at http://www.nursing.twsu.edu/clp.

Using the Medium to Advantage

Online assessment offers a number of advantages ("Assessing Students" 1999; Juchnowski and Atkins 1999; Ravitz 1998):

- Ease of distribution
- Timeliness (when the assessment is available and how long it is available)
- Provision of feedback—scores and explanations may be given immediately; e-mail allows for both individual and group feedback; learner feedback to the instructor can be incorporated immediately into the course
- Links to tracking and management systems
- Interactivity (see the article on page 2)

"If WWW-based learning systems simply mirror the pragmatic weaknesses in the assessment process practiced by educators in traditional settings, there will be a lack of emphasis on the special advantages that the computer can provide" (Hopper 1998, p. 332). Assessment at a distance should take advantage of the best features of the online environment. Nelson (1998) describes the Web's potential for real-world, authentic performance assessments. Web-based assessment enables true scaffolding (Hazari and Schnorr 1999); for example, an instructor can develop critical thinking questions based on the content and tenor of online discussion, rather than having a predetermined set of questions. The online environment enables learners to regulate and monitor their own learning (Hazari and Schnorr 1999; Ravitz 1998). Informal quizzes can give learners instant feedback to gauge their understanding of a topic; hyperlinks can lead learners to sources that explain incorrect answers. "With its flexible participation structures, the Internet allows learners to pace their own activities, share information at opportune times, receive feedback and interact with others, all while building a permanent record of their activities and what they have learned" (Ravitz 1998, n.p.).

The unique characteristics of the Web as a hypermedium give online learning environments the potential to facilitate dialogue—between learners and materials, their instructors, and fellow learners (Wild and Omari 1996). The "learning community" model enables learners to conduct collaborative projects, engage in teamwork, and adopt a variety of roles—all aspects of the contemporary workplace (Marshall 2000). Assessments of qualitative aspects such as coherence and comprehensiveness of projects, team functioning, and interpersonal skills can thus reflect how learners will be evaluated in the world of work.

Integration of content, online tasks, and assessment is an essential element. Hedberg and Corrent-Agostinho (2000) describe how Web-based group project tasks were completed at various intervals during a course rather than at the end of semester. The tasks thus became resources that learners accessed to assist them with the final group project.

Distance Learning Assessment Principles

Innovations in Distance Education is a Penn State initiative that developed a set of principles and practices to guide the effective use of distance education. The essential principles for assessment of online learning, with examples of ways to put them into practice, are as follows (PSU 1998):

1. *Assessment instruments and activities should be congruent with the learning goals and skills required of the learner throughout a distance education program or course.*

Representative Practices

a. Design the instructional activities in the same form and methods as will be used to measure mastery of the program goals.
b. At the start of the program, communicate the planned assessment and measurement strategies to the learner. Clearly state the nature, duration, due date, and impact on program grade of all assignments and measurement techniques.
c. Where possible, provide assessment and measurement techniques and options that capitalize on the unique characteristics and situations of the distance learner.

2. *Assessment and measurement strategies should be integral parts of the learning experience, enabling learners to assess their progress, to identify areas for review, and to reestablish immediate learning or lesson goals.*

Representative Practices

a. Consider a variety of "low-stakes" assessment and measurement strategies that enable learners to gauge their progress without affecting course grade or performance measurement.
b. Create automated systems (e.g., online quiz tools, database programs) that can provide immediate feedback, relevant suggestions, and guided support.
c. Develop techniques and systems that support learner-to-learner interactions for assessment and measurement.
d. Design as many self-check activities as possible within the distance education program, enabling students to adjust their progress within the course.
e. Consider credit for student effort as one component in the assessment process when the skill being taught is complex.

3. *Assessment and measurement strategies should accommodate the special needs, characteristics, and situations of the distance learner.*

Representative Practices

a. Consider the use of synchronous technologies such as teleconferencing or interactive compressed video for providing learners immediate assessment on work in progress.
b. Consider the use of asynchronous technologies such as e-mail, bulletin boards, voice mail, fax, and/or other technologies to support assessment and measurement activities.
c. Select media carefully when planning an assessment, recognizing that the use of several different media might be appropriate. For example, e-mail might be used to have students *describe*, online chats or telephone interviews might be used to have students *discuss*, and videotape might be used to *demonstrate* oral presentation skills or physical interactions, such as a counseling session.
d. Where possible, use assessment and measurement strategies that use resources local to the distance learner. For example, use projects based on learners' employment as part of the assessment and measurement for the program.
e. If needed, help students make local arrangements to complete course assessments and evaluations.

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Web Resources

Assessing Students Online. http://www.newcastle.edu.au/department/so/assess.htm. This site discusses student-centered learning; the function of assessment; assessment outcomes, mechanisms, and planning; advantages and disadvantages of online assessment; and when it may not be suitable. It also includes links to programs that can be used to create online tests and tutorials.

Assessment/Testing/Evaluation Issues (Module 5-Evaluation). http://online.parkland.cc.il.us/ofh/Assessment/Mod5Issues.htm. This checklist of issues that should be considered when assessing online is part of the Online Faculty Handbook from Parkland College's Department of Virtual and Distance Learning.

On-Line Evaluation: Multiple Choice, Discussion Questions, Essay, and Authentic Projects. http://wind.cc.whecn.edu/~gnelson/paper/TCC-98.html. Describes an adaptation of traditional assessment to the online environment with specific examples in earth sciences. Emphasis is on authentic assessment of students' communications skills, problem-solving ability, and teamwork.

RMIT University School of Business, Melbourne, Australia. http://www.bf.rmit.edu.au/vet/man/inf401/html/assessment.html. This model of online assessment shows how to present assessment tasks and criteria as well as sequence the learner pathway. Includes task descriptions, links to more information, assessment criteria, deadlines, and the weightings of the different tasks.

Tools and Techniques

A Beginner's Introduction to On-Line Web-Based Testing: http://www.unb.ca/web/econ/sephton/testing/. Discusses the desirable features of online tests and software and offers suggestions for developing programs and getting free ones. Includes the nitty-gritty of getting testing websites to work. Provides links to do-it-yourself sites on Java, JavaScript, Perl, and C programming.

Creating Multimedia/Interactive Tests for the Internet in 10 Minutes. http://www.aln.org/alnweb/magazine/issue2/rob.htm. An article from Asynchronous Learning Networks Magazine describes QuizPlease software, which is designed to offer tutoring as well as testing.

Online Educational Delivery Applications: A Webtool for Comparative Analysis. http://www.ctt.bc.ca/landonline/ or http://www.olin.nf.ca/landonline/. Designed to help educators evaluate and select online delivery software. Describes and compares the most viable applications in use, focusing on technical specifications, instructional design values, media capabilities, tools, ease of use, potential for collaboration and connectivity, and contact information.

QuizCODE—A Tool for Online Assessment and Feedback. http://www.enable.evitech.fi/enable99/papers/quizcode/quizcode.html. Describes QuizCODE XML-based assessment software. Includes examples of future uses such as delivering quizzes over personal data assistants and mobile phones.

Rubrics for Web Lessons. http://edweb.sdsu.edu/triton/July/rubrics/Rubrics_for_Web_Lessons.html. This site discusses authentic assessment and the use of rubrics with examples, templates, and links to further reading.

The CASTLE (Computer ASsisted Teaching and LEarning) Toolkit. http://www.le.ac.uk/cc/ltg/castle/index.html. These tools make it possible to create and manage online interactive multiple choice questions. Includes tips and good practice for question and test design.

The Design, Development and Delivery of Internet Based Training and Education. http://teleeducation.nb.ca/media/03.2000/ddd-ibte/index.html. Contains An Inventory of Design, Development, and Delivery Software for Internet-Based Learning, a comparison of 33 products such as QuestionMark, Toolbook, and FirstClass.

Website Building Tools

CGI Script Archive: bignosebird.com/carchive/bnbform.shtml

Matt's Free Perl CGI Scripts: http://www.worldwidemart.com/scripts/

Page Tutor: http://www. pagetutor.com. Free HTML tutorials; tables, frames, and forms tutorials; a MouseOver tutorial; a javascript tutorial; password protection script; and lots of resources for beginning and advanced HTML authors and web designers.

Conferencing Tools

Conferencing Software for the Web: http://thinkofit.com/webconf/. A guide to Web software (free and commercial) for text-based, asynchronous group discussions, maintained by David R. Woolley.

Meeting Web: www.meetingweb.com Conferencing software

Toolbook II: http://home.click2learn.com/ (formerly Asymetrix)
Assistant: e-Learning authoring program; Instructor: high-end authoring tool designed for creating e-Learning courses and applications

Testing Tools

Online Exercises System: http://math.uc.edu/onex/demo.html
Question Mark: http://www.qmark.com/
Self-Test: www.usq.edu.au/users/taylorja/Selftest.htm
WebTest: http://fpg.uwaterloo.ca/WEBTEST/WEBTEST_intro.html

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